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ABSTRACT

This study analyzes data from a recent survey conducted for a national educational video series to measure teachers' perceptions of the effectiveness of technology, video and Web-based materials. Research questions focused on perceptions of K-12 classroom educators on: the role technology plays in enhancing learning and learning environments; whether technology facilitates the learning of classroom content as aligned with national mathematics and/or science standards; whether the school administration provides adequate support with respect to training in the use of technology for the classroom; and whether school administrators provide adequate support with respect to access to technology in the classroom. Following the introductory section that outlines the background, rationale, and research questions of the study, the paper presents a review of the literature, describes the methodology, and briefly discusses the two phases of analysis. Sample survey questions are appended. (Contains 24 references.) (AEF)

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Evaluating teacher's perceptions of technology use in the K-8 classroom

Paper presented at the
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Table of Contents

INTRODUCTION 1

Background 1
Rationale 1
Statement of Research Questions 2

REVIEW OF THE RELEVANT LITERATURE 2

METHODOLOGY 6

Population 6
Sample 6
Gender and occupation 6
School Type 7
School Location 8
Highest Degree Status 8
Ethnicity 8
Age and Years of Educational Experience 8
Instrument 9

ANALYSIS 9

Phase I of analysis 9
Phase II of analysis 10

APPENDIX I 11

REFERENCES 13

Introduction

Background

Modern society has moved from one based on industrialization to one based on information. Through electronic communication, information can now be shared simultaneously with multiple users across the globe. Computer technology has accelerated the rate of economic change throughout the world and in response to this rapidly evolving society, technology-enhanced skills are needed to survive. These recent advances in information technology have made it mandatory for students to utilize technologies like graphing calculators, multimedia computers and Internet resources to be effective members of the mathematical and scientific world in which we live.

Current employers are looking for individuals who can effectively communicate, solve problems, employ mathematics-skills and use technology effectively in all these endeavors (AAAS, 1993; ISTE, 1999; Lewis, 1999; Rosenberg et al., 1989). Coupled with this charge is the challenge to discern the nature of knowledge itself (Lewis, 1999). Lewis supports this claim by documenting the vast array of dissemination technologies available today like television, computers, cables, satellites, wireless, etc., and states that this multi-modal network fragments information more than consolidating knowledge for effective consumption (1999).

Education must move towards a standards based system where the content taught has predetermined outcomes and is evaluated against appropriate forms of assessment aligned to those predetermined standards (Resnick & Resnick, 1985) to make our students effective members of society and discerning consumers of information. With the implementation of national standards in science, mathematics and technology, and the increased plans for k-12 connectivity (Levinson & Surratt, 1999), teachers must receive the training necessary to properly infuse technology competencies into the curriculum. Only by having the access, time and training for these technology tools can teachers implement them within the learning context, using the technology for authentic solutions in a performance-based environment (Warner & Akins, 1999). The question then is, "Given the need for technology-enhanced education, and the plethora of resources and dissemination channels available, how do we harness this enabling mechanism?" One solution may be to focus as mentioned above on the standards of interest to our learners. By concentrating on the learning outcomes of our students, we can then determine what technologies may best suit these outcomes (Lewis, 1999). These technologies will determine what skills are needed by the classroom teacher to facilitate these technology-enabled learning outcomes.

Rationale

There has been much study on the topic of teachers' use of technology. There has been debate over what variables should be assessed, as well as the design of program evaluations. In an article in Education Week (1999), Trotter raises concerns over problems with measurement of project success. He offers suggestions for improvements

in research, including the use of more longitudinal studies, focusing on fewer technologies, and increasing sample size. In the area of reporting, giving more detail so as to ease replication is suggested as well (Trotter, 1999). Towards this end, this study will analyze data from a recent survey performed for a national educational video series. The purpose of the analysis was to measure teacher's perceptions on the effectiveness of technology, video and web-based materials. The research questions posed herein attempt to address these concerns and define the study.

Statement of Research Questions

Following a preliminary examination of the survey data inquiring into teacher perceptions concerning the effectiveness of technology, the following questions were developed for more rigorous statistical analysis:

1. What are the perceptions of k-12 classroom educators on the role technology plays in enhancing learning and learning environments?
2. As perceived by k-12 classroom educators, does technology facilitate the learning of classroom content as aligned with national mathematics and/or science standards?
3. As perceived by k-12 classroom educators, does the school administration provide adequate support with respect to training in the use of technology for the classroom?
4. As perceived by k-12 classroom educators, do school administrators provide adequate support with respect to access for the use of technology in the classroom?

The first phase of this study prepared the data for a detailed statistical examination using descriptive and frequency analysis. The second phase of the study focuses on the correlative relationships in the data. To support the second phase of the study, a review of the relevant literature was performed.

Review of the Relevant Literature

Technology impacts our lives on a daily basis. Society accepts computers and expects schools to prepare students for a world requiring computer literacy. It will be necessary for students to become proficient in the use of technology to be successful in the 21st century. Many educational institutions are currently failing to capitalize on the myriad of learning possibilities that technology provides (Jarrett, 1998). Many believe the most effective use of technology occurs when technology is transparently integrated into the core curriculum (Cohen, 1988). Both the National Science Education Standards (NSES) and the National Council of Teachers of Mathematics (NCTM) standards call for skills, knowledge and attitudes that are effectively developed when technology is one of the instructional strategies employed by the teacher (Council, 1996; Lappan, Carl, Frye, & Gates, 1991). This poses a challenge to educators who, with limited time, resources and training, are attempting to appropriately infuse technology enhanced learning

materials into the curriculum (Manouchehri & Goodman, 1998). Unfortunately, teachers use the computer mostly for management tasks, or drill and practice exercises (Hannafin & Savenye, 1993). There are many reasons for teachers' resistance toward computers specifically, from resentment in competing for attention with computers to frustration in learning how to use them. Infusing technology fosters a student-centered approach, shifting the teacher away from being the "sage on the stage" to the "guide on the side".

A teacher's personal theory of learning also effects how he or she goes about teaching and in turn may effect their decision on how to use technology in their classroom. Teachers have specific goals for learning and feelings on what works best for them. Though it may not be explicitly stated, a teacher's theory of learning will affect the content and strategies he or she feels will lead to understanding on the students' part (Duffy & Jonassen, 1991).

There are no clear answers in the literature to the question "Do teachers' theories of learning affect their computer use?" There are studies that show a relationship (Hannafin & Freeman, 1995) and those that do not (Olech, 1999). Olech looked for a relationship between pedagogical beliefs and affinity for computer use by treating behaviorist and information processing philosophies separately rather than combining them under objectivism. This differs from the research of Duffy and Jonassen (1991), who describe the philosophies of behaviorism and cognitive information processing as falling under the single epistemology of objectivism. Objectivism states that knowledge and meaning are independent of our beliefs, existing within the world independent of our understanding (1991). Thus, understanding is to know the world as it already exists, regardless of our perception.

Olech (1999) found that while no teacher selected statements from a single pedagogical theory, constructivist statements were selected most often. Constructivism agrees with objectivism that there is meaning in the world around us, but states that we construct it through our experiences and perceptions (Duffy & Jonassen, 1991). Therefore meaning is different for different people and learning is a process of our interactions with others and the physical world.

In summation, Olech (1999) found that teachers who chose statements indicating a belief in behaviorist pedagogy were less likely to use computers; the stronger the behaviorist perspective, the less likely they were to use computers. However, the best predictors for computer use were found to computer relevance and subjective norms (perceptions of the expectations of administrators, peers, students and parents). Because computers allow for student-initiated activity and present varied pathways of learning, they tend to be associated more with constructivist teaching styles.

Historically, the average person's recollection of school involves teacher-centered instruction. In this light, society views the teacher as a manager, controlling the

classroom environment. This conceptual view may in turn influence teacher's use of computers (Hannafin & Savenye, 1993). In contrast, computers allow for a more student-centered approach to knowledge acquisition turning control of learning over to the students. This new technology-assisted method of instruction may antagonistically influence teachers, as it is a view that does not fit the view of much of society (Hannafin & Savenye, 1993).

Consequently, teachers have been found to employ three strategies with their interactions with technology: avoidance, integration, and technical specialization (Evans-Andris, 1995). In this ethnographic study of elementary school teachers, Evans-Andris (1995) found that though the majority of teachers provided their students with opportunities to use the computer, 62% distanced themselves from computers. The remaining 38% embraced computers, making opportunities to use computers a reality. Why do 62% of the teachers in this study "distance" themselves from technology? Jarrett states that learning to teach effectively with technology involves a significant learning curve for many teachers and that most teachers take at least 5 years to become proficient in it use (1998). Consequently, during the early stages of technology, there may be significant technical hurdles to overcome. This would tend to suggest that technology access in and of itself is not sufficient for infusion into the classroom.

Even if access is granted, the effective integration of technology will be determined by factors such as the extent to which teachers value the benefits of technology in facilitating learning and the degree to which teacher technology skills are practiced in the context of their daily profession (Lewis, 1999; Simpson, Payne, Munro, & Hughes, 1999). This may create some uneasiness among teachers, and thus the need for administrative support and training as mentioned previously.

Teachers' attitudes and perceptions toward technology could change with proper staff development and administrative support, for teachers' feelings about technology are tied to their work environment (Chin & Hortin, 1993). Manouchehri and Goodman (1998) lend credence to these claim stating that administrative support is needed to buttress the teacher's efforts and to provide encouragement to sustain educators throughout their demanding teaching schedule.

Still further studies in the literature are found supporting the notion that teacher may be inhibited in the use of technology due to inadequate technology training skills. Hurley and Mundy (1997) conducted a survey to examine elementary teachers' perceptions of their preparedness to use technology, the adaptability of technology to their personal teaching style, and the effect of technology on their students. The results showed that teachers had positive perceptions of all three variables (Hurley & Mundy, 1997).

A factor that was overlooked in the Hurley and Mundy (1997) study was the fact that the school from which the sample was pulled had recently switched from a standard curriculum to one that incorporated technology at every level. The teachers who were

there chose to be there, so they must have already felt positively about technology in the classroom. Though the sampling is suspect, the positive correlation found between perception of preparedness for technology and technology's effect on students, and perception of preparedness for technology and adaptability of technology to teaching style highlights the importance of training and staff development in increasing teachers' positive perceptions of technology. In essence, schools where staff development processes are more collaborative between administration and teachers, emphasizing a student-centered environment, tend to score significantly higher in achievement scores than schools that do not adhere to this method (Weathersby & Harkreader, 1999). Weathersby and Harkreader (1999) showed that when teachers were more sure of the support they received, and the leadership had more capacity for direction and support, student-centered technology-assisted instruction facilitated significantly higher students test scores than schools that did not employ this method.

In conclusion, from examining the literature, there are at least six variables hindering teachers' use of technology in k-12 education:

1. Resistance from being the sole disseminator of knowledge
2. Resistance from the learning curve required to use technology
3. Teacher's personal theory of learning
4. Society's historical view of the teacher as the disseminator of knowledge
5. Inadequate administrative support for teachers in the use of technology
6. Inadequate teacher training in the proficient use of technology

To help address the current inadequacy of technology training for teachers, training institutions are now focusing on facilitation of technology competencies (Simpson et al., 1999) like those determined by International Society for Technology in Education (ISTE, 1999):

1. Explore, evaluate and use computer technology-based materials
2. Use computers for problem solving data collection, information management, communications, presentations and decision making
3. Design and develop student learning activities that integrate computing and technology for a variety of student grouping strategies and for diverse student populations
4. Demonstrate skill in using such productivity tools as word processors, databases, spreadsheets and print/graphic utilities

Infusing technology into the classroom is a multi-faceted problem that appears to require a multi-faceted solution. While there are many potential impediments to implementing technology-assisted education, there are many potential benefits of technology use in the classroom as well.

Interaction permitted via technology may enable students to develop strengths like problem solving, persistence and initiative (Jarrett, 1998). There are many teachers who feel that effective integration of technology may support the use of problem-based scenarios and foster the development of critical thinking and communication skills

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(AAAS, 1993; Council, 1996; Rosenberg et al., 1989). Jarrett (1998) cites multiple research studies that provided repeated evidence that technology may improve writing skills, cooperative learning and motivation.

With respect to adolescent development, technology can help mathematics students in middle school make the critical jump from concrete to abstract reasoning, empowering students via observation and creation of multiple representations of mathematical constructs (Jarrett, 1998). With user-chosen interfaces, dual processing modes of encoding content and varied learning pathways, technology may better respond to multiple student learning styles (Moore, Myers, & Burton, 1994). Technology has also been shown to increase self-efficacy of students by instilling more success in the learning environment and in allowing students to take more control of their own learning (Means & Olson, 1997).

Methodology

Population

A survey was generated to gather feedback on the effectiveness of a nationally televised instructional video series and website from participants who completed an online registration form. The population was composed of individuals who completed the online registration form voluntarily and provided their mailing address. From the registration form any of the following types of individuals could have made up the population of interest: Principal, Teacher, Librarian, Home Schooler, Media Specialist, Math Coordinator, Science Coordinator, or Technology Coordinator. The "School-type" classification for the population included Public, Private/Parochial, Native American School, Home School, 2-year college or 4-year college. The "Population-type" for the school demographic could have been rural, urban or suburban.

Sample

As described previously, one thousand participants accurately completed the online registration process by providing all demographic information requested. From this population of 1,000 registered participants each were mailed a hardcopy evaluation survey with a postage-paid return envelope. The sample consisted of 305 individuals who responded to the survey, of which 300 provided complete responses for inclusion in the statistical analysis.

Gender and occupation

The final sample of 300 individual consisted of 71 males (23.7% of sample) and 229 females (76.3% of sample). With respect to educational position, 230 of the volunteer respondents in the sample were teachers (76.7% of sample), six were home

schoolers (2% of sample), three were technology coordinators (1% of sample), 15 were principals (5% of sample), two were math coordinators (.7% of sample), eight were science coordinators (2.7% of sample), 21 were librarian or media specialists (7% of sample), 14 were university instructors (4.7% of sample) and one was listed as "other" (.3% of sample). Thus, over 75% of the survey respondents were classroom educators. Table 1 is a listing of the job types percentages in the sample.

Table 1. Frequency and Percentage of 300 sample respondents

Type of educational occupation	Frequency	Percent	Cumulative Percent
teacher	230	76.7	76.7
home schooler	6	2.0	78.7
technology coordinator	3	1.0	79.7
principal	15	5.0	84.7
math coordinator	2	.7	85.3
science coordinator	8	2.7	88.0
librarian/media specialist	21	7.0	95.0
university instructor	14	4.7	99.7
other	1	.3	100.0
Total	300	100.0	

School Type

The majority of schools that participated in this survey were public (87.7% of the sample), while 7.7% were private, 2.0% were home school in nature, .3% was of the community college type and 2.3% were either colleges or universities. Table 2 is a listing of all school types.

Table 2. Percentages of school type making-up sample.

School Type	Frequency	Percent	Cumulative Percent
Public	263	87.7	87.7
Private	23	7.7	95.3
Home School	6	2.0	97.3
Community College	1	.3	97.7
College or University	7	2.3	100.0
Total	300	100.0	

School Location

The majority of schools types in the sample were Suburban (37.3%), while rural schools constituted 34% and urban school made up 26.3% of the sample. Seven survey-respondents failed to provide their school type data and thus the results above constitute 293 out of 300 respondents.

Highest Degree Status

From the sample 297 out of 300 survey participants provided information on the highest degree they had obtained. The majority of the sample respondents (200) had received their Masters or Masters equivalency degree, constituting 66.3% of the sample. Next, 84 respondents (28% of sample) had received their baccalaureate (BA/BS) degree. Nine survey respondents (3% of sample) had their doctorate degree while three respondents (1% of the sample had received a two-year associates degree. Finally, for two respondents, or .7% of the sample, a high school diploma or equivalency degree was the highest degree achieved.

Ethnicity

Of the 300 survey respondents, 292 provided their ethnicity information. The majority of the participants were Caucasian, accounting for 86.3% of the sample (259 respondents). Twenty-three respondents were African American (7.7% of the sample), while six respondents were Hispanic (2% of the sample). Finally, three respondents were Native American (1% of the sample) and one respondent was Asian (.3% of the sample).

Age and Years of Educational Experience

All survey respondents provided the number of years they had been in the educational system and 286 out of 300 provided their age. The range of the respondents was 52.0 with a minimum age of 23 and a maximum age of 75-year-old. The mean age of 286 respondents was 45 with a standard deviation of 8.675. The range of educational experience varied from one to 49 years, with a mean of 16.29 years educational experience overall. The standard deviation for years of educational experience was 9.257. Table 3 is a listing of these results.

Table 3. Descriptive Statistics for age and years of experience for participants

Statistic variables	Number of Respondents	Range	Minimum	Maximum	Mean	Std. Deviation
Age	286	52.00	23.00	75.00	45.0455	8.6751
Years teaching or in profession	300	48.00	1.00	49.00	16.2933	9.2574

Years teaching or in profession	300	48.00	1.00	49.00	16.2933	9.2574

Instrument

The survey instrument was a created by the producers of the instructional video and was derived from a previous survey instrument. The producers asked respondents demographic data and questions about the learning effectiveness of the video and website. Given this, there is no information on internal reliability measures used previously. Internal consistency reliability coefficients will be calculated when the data from the survey is examined in Phase II of the analysis.

The internal validity of the instrument was not correlated against the administration of a second tool, but the variables considered were reviewed by content and education experts, such that the data requested would indeed provide a measure of the constructs in question. The integrity of the instrument was also considered valid in that the results were going to be used for future revisions of the instructional material and in securing continued congressional funding for the project.

The cross-sectional survey instrument consisted of a 67-item questionnaire made up of a five-point Likert scale and multiple-choice response items. The survey was mailed to all 1,000 registered participants of the instructional program. As stated previously, the type of respondent ranged from k-12 classroom educators to administrators or curriculum coordinators. From the 1,000 mailed surveys, 305 surveys were returned with 300 of the respondents having nearly complete item responses, such that they could be included for statistical analysis. The instrument itself consisted of 10 distinct thematic areas, which were Instructional Technology and Teaching, Instructional Programming and Technology in the Classroom, Overall Assessment, Program Use, Lesson Guides, Classroom Activity, Web-based Activity, Web Site, Classroom Environment and Demographics. Within each of these topics anywhere from four to nine questions were posed to capture areas of interest. A sample of the survey can be found in Appendix I.

Analysis

Phase I of analysis

The intent of the data analysis is to look for correlational relationships between constructs. A construct is a high-level mental abstraction that cannot be directly measured. Instead, indicators of that construct are inferred by observing related behaviors. For example, motivation is a construct. Based on a review of the related

literature, it may be found that indicators of motivation include time spent on task, punctuality to class, number of questions asked during class, etc. These indicators would then be directly measured.

The original survey data was provided in comma-delimited text file format. The data was imported into SPSS (Statistical Package for Social Sciences) for initial analysis. Many of the survey items contained multiple responses, which would make in-depth statistical analysis of single constructs impossible.

To address this problem, responses were recoded to reflect the variable type, either continuous, as in a Likert scale, or categorical as in dichotomous responses. For example, questions with multiple answers, such as "Which of the following are among the objectives you have for student computer use?" had 10 possible items that for selection, among them "mastering skills" and "analyzing information." A respondent could select all 10 answers, so the one question was broken down into 10, with one dichotomous response provided for each. Frequency data was then collected on these newly created categorical variables. Descriptive data, such as mean, median, mode, and standard deviation was collected on the continuous variables.

The recoding of the data set will allow for a factor analysis in Phase II of the data analysis. In factor analysis, every possible variable combination is correlated such that where strong relationships exist, underlying factors or constructs will emerge from the data.

Phase II of analysis

The second phase of analysis will begin with a factorial analysis of the data. It is predicted that the factorial analysis will expose three to five underlying composite variables, or constructs. A test of internal consistency of the survey questions will then be performed. Cronbach's Alpha inter-item correlation will be used to test whether the items of each construct are asking questions about that same construct.

After internal consistency is evaluated, an examination of the correlational relationships between identified constructs will be performed. Next, an analysis of the correlational relationships between the constructs and the demographic data will be run to identify potential relationships.

Due to the fact that the sample was not randomly drawn from the population, but volunteered by respondents, external reliability or generalizability to the population may be suspect. One strategy to increase the generalizability of the sample to the population is to administer the original instrument to a portion of the non-respondents. If the data collected from non-respondents correlate highly with the original data set, the results from the original sample can be generalized to the entire population with confidence.

Appendix I

Sample Survey Questions:

Instructional Technology and Teaching	Disagree			Agree		No Opinion
Instructional technology….	1	2	3	4	5	9
Enables teachers to teach more effectively	1	2	3	4	5	9
Enables teachers to accommodate different learning styles	1	2	3	4	5	9

Instructional Programming and Technology in the Classroom						
Increasingly, schools have greater access to instructional programs.	1	2	3	4	5	9
Teachers received the training and technical assistance to support classroom use of instructional technology	1	2	3	4	5	9
Administrators support and encourage teachers to use instructional technology in the classroom	1	2	3	4	5	9

Overall Assessment	Disagree			Agree		No Opinion
The programs met their stated objectives.	1	2	3	4	5	9
The program content was aligned with the National Mathematics and Science Standards.	1	2	3	4	5	9
The program programs presented science as a process requiring creativity, critical thinking, and problem solving skills.	1	2	3	4	5	9

Lesson Guides						
The directions/instructions in the lesson guides were easily understood.	1	2	3	4	5	9
The layout of the lesson guides presented the information clearly and was easy to read.	1	2	3	4	5	9
The lesson guides were a valuable instructional aid.	1	2	3	4	5	9

Classroom Activity

The classroom activity (experiment) was easily implemented into my lesson plan.	1	2	3	4	5	9
The classroom activity (experiment) complemented the lesson for each show.	1	2	3	4	5	9
The classroom activity (experiment) was developmentally appropriate for the grade level.	1	2	3	4	5	9

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